DIALOG(R)File 351:Derwent WPI

010486179 **Image available**
WPI Acc No: 1995-387559/199550
Related WPI Acc No: 1986-287334; 1994-113108
XRAM Acc No: C95-166789
XRPX Acc No: N95-283262

In-line or flat lead type resin mould semiconductor device - has electrodes of IC or LSI chip joined to bump electrodes of lead frame substrate

Patent Assignee: KYUSHU HITACHI MAXELL KK (HITM)
Number of Countries: 001 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 7263614	A	19951013	JP 93102900	A	19850314	199550	B
			JP 9557537	A	19850314		
JP 2549277	B2	19961030	JP 93102900	A	19850314	199648	
			JP 9557537	A	19850314		

Priority Applications (No Type Date): JP 93102900 A 19850314; JP 9557537 A 19850314
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 7263614	A		5	H01L-023/50	Div ex application JP 93102900
JP 2549277	B2		5	H01L-023/50	Div ex application JP 93102900 Previous Publ. patent JP 7263614

Abstract (Basic): JP 7263614 A

The device comprises the electrodes of an IC or LSI chip connected respectively to the bump electrodes of a lead frame substrate, and has the S content of an Ni material forming each of the bump electrodes controlled at 0.04% or less.

ADVANTAGE - The chip and the substrate are reliably interconnected.

Dwg.3/7

Title Terms: LINE; FLAT; LEAD; TYPE; RESIN; MOULD; SEMICONDUCTOR; DEVICE; ELECTRODE; IC; LSI; CHIP; JOIN; BUMP; ELECTRODE; LEAD; FRAME; SUBSTRATE
Derwent Class: A85; L03; U11
International Patent Class (Main): H01L-023/50
International Patent Class (Additional): C22C-019/03; H01L-021/321
File Segment: CPI; EPI
?

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号

特開平7－263614

(43)公開日　平成７年(1995)10月13日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｈ０１Ｌ　23/50	Ｖ			
	Ｓ			
Ｃ２２Ｃ　19/03	Ｍ			
Ｈ０１Ｌ　21/321				
		9169－4M	Ｈ０１Ｌ　21/ 92　６０３　Ｂ	

審査請求　有　発明の数２　ＯＬ　（全５頁）

(21)出願番号　特願平7－57537

(62)分割の表示　特願平5－102900の分割

(22)出願日　昭和60年(1985)３月14日

(71)出願人　000164461
九州日立マクセル株式会社
福岡県田川郡方城町大字伊方4680番地

(72)発明者　鳴津　博士
福岡県田川郡方城町大字伊方4680番地　九州日立マクセル株式会社内

(72)発明者　山下　康夫
福岡県田川郡方城町大字伊方4680番地　九州日立マクセル株式会社内

(72)発明者　鈴記　正義
福岡県田川郡方城町大字伊方4680番地　九州日立マクセル株式会社内

(74)代理人　弁理士　武　顕次郎

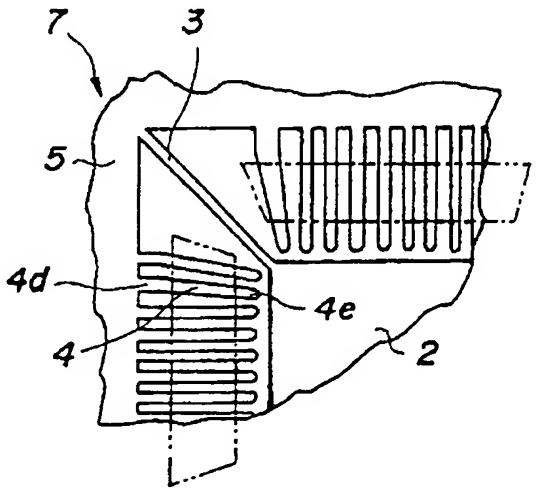
最終頁に続く

(54)【発明の名称】　半導体装置

(57)【要約】

【目的】　リードフレームが十分な機械的強度を有し、しかも半導体チップの電極とリードフレームとの接合が確実な、信頼性の高い半導体装置を提供する。

【構成】　半導体チップ１の電極にリードフレーム７のバンプ４ｆを接続してなる半導体装置において、前記バンプ４ｆを形成するニッケル材のイオウ含有率が０．０４％以下に規制されていることを特徴とするとする。



1

【特許請求の範囲】

【請求項１】　半導体チップの電極にリードフレームのバンプを接続してなる半導体装置において、
前記バンプを形成するニッケル材のイオウ含有率が０．０４％以下に規制されていることを特徴とする半導体装置。

【請求項２】　半導体チップの電極にリードフレームのバンプを接続してなる半導体装置において、
前記バンプを形成するニッケル材がカーボンとイオウを含み、カーボンの含有率が０．０１～０．０４％の範囲に規制され、イオウの含有率が０．０１～０．０４％の範囲に規制され、かつカーボンとイオウの合計含有率が０．０７％以下に規制されていることを特徴とする半導体装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、ＩＣ，ＬＳＩ等の半導体チップを備えた半導体装置に係り、特にその半導体装置のリードフレームに関するものである。

【０００２】

【従来の技術】従来より半導体チップを樹脂モールドで一体化して複数のピンを突設した半導体装置の組立てには、金属製のリードフレームが用いられている。このリードフレームの形状は図７に示すように、半導体チップ１を取り付ける矩形のタブ２をその四隅において支持するタブリード３と、タブ２の周縁に内端を臨ませる多数のフインガ４と、これらフインガ４及びタブリード３の外端を支持する枠部５と、枠部５の両端縁に沿つて定間隔に設けられたスプロケツト孔６とから構成されている。

【０００３】このようなリードフレーム７を用いて半導体装置を組み立てるには、まずタブ２上に半導体チップ１を取り付け、半導体チップ１の各電極とこれに対応するフインガ４の内端（先端部）を直接に接合し、枠部５の内側領域を合成樹脂でモールドし半導体チップ１を被覆して、次いで枠部５を切除することによりフラツトリードあるいはインライン型の半導体装置を得ていた。

【０００４】

【発明が解決しようとする課題】ところで、従来の半導体装置ではリードフレームの機械的強度に問題があり、本発明者らはこの点について検討した結果、光沢剤の含有率が影響していることを見出した。すなわち、ニッケルの電鋳によってリードフレームを形成する場合、光沢剤としてカーボンならびにイオウが使用されるが、この光沢剤の含有率が通常０．１％程度である。このように光沢剤の含有率が高いと、半導体チップとの接合（半田付け）時にリードフレームの温度上昇により、ニツケルが脆化して機械的強度が低下する。また光沢剤を全く含有しなければ、最初から機械的強度が弱く、加工時の変形によつて隣のリードフレームと接触して短絡する恐れ

2

がある。

【０００５】特に光沢剤中のイオウの含有率が高いと、前述の問題に加えて、リードフレームのニッケルと半田中のスズとが反応して、密着性の悪いＮｉ－Ｓｎ合金層が形成され、リードフレームが半導体チツプから剥離することがある。

【０００６】本発明の目的は、前述した従来技術の欠点を解消し、リードフレームが十分な機械的強度を有し、しかも半導体チツプの電極とリードフレームとの接合が確実な、信頼性の高い半導体装置を提供することにある。

【０００７】

【課題を解決するための手段】前記目的を達成するため、第１の本発明は、半導体チップの電極にリードフレームのバンプを接続してなる半導体装置において、前記バンプを形成するニッケル材のイオウ含有率が０．０４％以下に規制されていることを特徴とするものである。

【０００８】前記目的を達成するため、第２の本発明は、半導体チップの電極にリードフレームのバンプを接続してなる半導体装置において、前記バンプを形成するニッケル材がカーボンとイオウを含み、カーボンの含有率が０．０１～０．０４％の範囲に規制され、イオウの含有率が０．０１～０．０４％の範囲に規制され、かつカーボンとイオウの合計含有率が０．０７％以下に規制されていることを特徴とするものである。

【０００９】

【作用】第１の発明のように、バンプを形成するニッケル材中のイオウの含有率を０．０４％以下に規制することにより、Ｎｉ－Ｓｎ合金層の生成を抑制して、半導体チツプとリードフレームとの接合を確実にすることができる。

【００１０】第２の発明のように、バンプを形成するニッケル材中のカーボンの含有率を０．０１～０．０４％の範囲に、イオウの含有率を０．０１～０．０４％の範囲に、かつカーボンとイオウの合計含有率を０．０７％以下に規制することにより、半導体チツプとの接合時におけるリードフレームの熱的影響によるニツケルの脆化を抑制して、十分な機械的強度を得ることができ、リードフレームどうしが接触したりするようなことがない。

【００１１】

【実施例】次に本発明の実施例を図とともに説明する。図１はフインガの一部を横断面にして示した斜視図、図２はフインガ先端部の縦断面図、図３はフインガの一部を示す平面図、図４は他の実施例を示すフインガの一部を横断面にして示した斜視図、図５はリードフレームの製造工程を示す図、図６はフインガ部のレジストパターンを示す平面図、図７はリードフレームの平面図、図８はフインガと半導体チツプの電極との接続部を示す断面図である。

【００１２】フインガ４は金属層からなり導電性を有

し、それの中央部下面にその長手方向Ｆ（図１参照）に沿つて条溝４ａを有し、図１に示すように半導体チツプの電極と接続される上面の両側には稜線が円弧状のフランジ部４ｂ，４ｃを備えている。条溝４ａは図３の二点鎖線で示すように、フインガ４の基部４ｄ及び先端部（内端部）４ｅを除く中間部分に形成され、この中間部における断面形状を略々コ字状として少ない材料で曲げに対する断面二次モーメントを増大させている。

【００１３】また、図２に示すようにフインガ４の先端部４ｅは半導体チツプ１の電極と接続される肉厚のバンプ４ｆが形成されている。この先端部４ｅと中間部分を連結する部分の下面には前記条溝４ａと略直交する方向に延びた凹部４ｇが形成され、凹部４ｇより先方に中間部分の上面より突出したバンプ４ｆが形成されている。

【００１４】図４はフインガ４の他の例を示した斜視図で、前記実施例のフインガ４の上面に更に金属薄膜４ｈを積層したものである。このようにすることでフインガ４の剛性を更に増加させることができる。

【００１５】図５は、このフインガ構造のリードフレームの製造工程を示すものである。

【００１６】まず（ａ），（ｂ）図に示すようにベース材として、例えばポリイミド，ポリエステル等の合成樹脂からなる厚さ３５～７０μｍ程度のフイルム８にプツシユバツク法によるプレス加工でデイバイス孔９を設ける。プツシユバツク法は（ａ）図の如くまず押型によつて所望部分を打ち抜き、次いで受型を再度上昇させて（ｂ）図の如く切抜片１０を一度穿つたデイバイス孔９内に嵌合、保持させる加工方法である。従つて、加工後はフイルム８はデイバイス孔９が開口されない（ｂ）図の状態で維持され、一枚のシートとして取扱うことができる。尚、このデイバイス孔９の形成時には、その他例えばスプロケツト孔６（図７参照）等の窓部も同時に形成することができる。

【００１７】次に開口されない前記フイルム８上には、（ｃ）図の如く銅などの導電性金属層１１が無電解メツキ，蒸着等の薄膜形成手段にて形成される。更に導電性金属層１１の上には（ｄ）図のようにフオトレジスト層１２が塗布され、もしくは、厚さ１５０μｍ程度のドライフイルム状レジスト層が貼着され、フオトマスク１３をかけて所望パターンに露光した後洗浄することにより感光した部分のみ取り除かれて、（ｅ）図の如きレジスト層１２が導電性金属層１１上に形成される。

【００１８】プツシユバツク後、この導電性金属層１１やフオトレジスト層１２は切抜片１０の脱落を防止する仮止め手段としての機能を有するもので、フイルムのように薄状物のプツシユバツクされた物のように脱落し易いものの仮り止めに特に有効である。

【００１９】次にこのフイルム８上に亜セレン酸や苛性ソーダ等により剥離処理を施し、ニツケルを電鋳すると、（ｆ）図に示すようにレジスト層１２が形成されていない導電性金属層１１の上に所望パターンのリードフレーム７が形成される。

【００２０】ニツケルでリードフレーム７を電鋳する際に光沢剤が添加されるが、この光沢剤はカーボンとイオウからなり、両者の合計が０．０７％以下に規制されている。そのうちカーボンの含有率が０．０１～０．０４％の範囲に規制され、イオウの含有率が０．０１～０．０４％の範囲に規制されている。カーボンとイオウの具体的な含有率は、前述の範囲内から適宜に選択される。

【００２１】光沢剤の含有率が０．０７％（すなわちカーボンの含有率が０．０４％ならびにイオウの含有率が０．０４％）を超えて高含有率になると、従来と同様に半導体チツプとの接合時におけるリードフレーム７の温度上昇により、ニツケルが脆化して機械的強度が低下する。一方、カーボンの含有率が０．０１％未満ならびにイオウの含有率が０．０１％未満、すなわち光沢剤が実質的に添加されていないと、リードフレーム７の機械的強度が最初から十分でなく、加工時の変形によつて隣のリードフレーム７と接触して短絡する恐れがある。

【００２２】このような理由からカーボンの含有率を０．０１～０．０４％の範囲に規制し、イオウの含有率を０．０１～０．０４％の範囲に規制して、かつカーボンとイオウの合計含有率を０．０７％以下にすることにより、半導体チツプとの接合時におけるリードフレーム７の熱的影響によるニツケルの脆化を抑制して、十分な機械的強度を得ることができる。

【００２３】また、イオウの含有率を０．０４％以下に規制することにより、従来のようなＮｉ－Ｓｎ合金層の発生を抑制して、半導体チップの電極とリードフレーム７との接続を確実にすることができる。

【００２４】電鋳形成後にレジスト層１２を除去することにより、全面にわたって導電性を有するベース材上にリードフレーム７が形成され、そのリードフレーム７のフインガ４が前記切抜片１０上に導電性金属層１１を介して保持されている。

【００２５】半導体チツプと接合するためにデイバイス孔９を閉鎖している切抜片１０を抜き落せば、（ｇ）図の如き断面のリードフレーム７が合成樹脂フイルム８上に形成される。この場合、導電性金属層１１は電鋳に必要な導電性を確保するために設ける程度の厚さ例えば５～１０μｍ程度であり、しかも導電性金属層１１のリードフレーム７が形成される表面に剥離処理が施されているから、抜き落し力は小さくて済みリードフレーム７を変形させることはない。

【００２６】このようにして切抜片１０を抜き落した後、半導体チツプ１が搭載されて、フインガ４と接続される。

【００２７】尚、上記実施例においては、リードフレーム７はベース材としての合成樹脂フイルム８上に形成したが、このようなベース材としては導電性のステンレス

5

などの金属フイルムを用いることもできる。

【００２８】この場合は、（ｃ）図に示す如き銅などからなる導電性金属層１１を新たに設ける必要がなく、金属フイルムの上にフオトレジスト層１２を形成し、直接電鋳によつて金属フイルム上にニツケル，銅，金やそれらの合金等からなるリードフレーム７を形成することが可能である。

【００２９】図６は、前記製造工程におけるフインガ部のレジストパターンを示す図である。

【００３０】フインガ部では、所望のパターンのフインガ用レジスト層１２の他に、フインガ４に対応する位置の非レジスト部１４の中央に、その長手方向に沿つたレジスト部１２ａが形成され、このレジスト部１２ａに対応して前述の条溝４ａが形成される。

【００３１】また非レジスト部１４の先端にはレジスト層１２によつて分離された円形の非レジスト部１５が形成されており、このようなレジスト層１２を有する金属上に電鋳作用を施すと、電鋳開始後の初期にあつてはフインガ４本体は、レジスト層１２によつて分離された円形の非レジスト部１５上に成長する金属層と別個に形成されていくが、電鋳が更に進行すると分離されていた非レジスト部１５上の金属とフインガ４本体とはレジスト層１２を越えて一体に連結する。そして電鋳によつて積層される金属の厚みは電流密度によつて左右されるから、平板状のフインガ４本体部に比べ点状の非レジスト部１５上の金属層はより肉厚となり、図２に示すようなバンプ４ｆを形成する。

【００３２】尚、図４に示すような金属薄膜４ｈを形成する場合には、前述の電鋳成形工程に加えて、第２次の電鋳成形を施せば良い。

【００３３】またニツケルなどの金属でリードフレーム７を電鋳する際、光沢剤が含有されない層と光沢剤が含有された層の二層を重ね合わせたリードフレーム７を作ることもできる。光沢剤を入れないで電鋳すると、表面が粗面化され凹凸の著しいものとなりこのため半導体チツプとの接合時の温度集中、特に圧接状態で接合する際の温度集中が起こり易く、しかも硬度も低いものとなり半導体チツプに大きな応力を加えずとも済み、接合を確

6

実なものとすることができる。

【００３４】一方、接合面と反対側に光沢剤入りの層を設ければ、リードフレーム７としての機械的強度を確保することができる。なお、光沢剤の含有率は０．０７％以下に制限する必要がある。

【００３５】

【発明の効果】第１の発明のように、バンプを形成するニッケル材中のイオウの含有率を０．０４％以下に規制することにより、Ｎｉ－Ｓｎ合金層の生成を抑制して、半導体チツプとリードフレームとの接合を確実にすることができる。

【００３６】第２の発明のように、バンプを形成するニッケル材中のカーボンの含有率を０．０１～０．０４％の範囲に、イオウの含有率を０．０１～０．０４％の範囲に、かつカーボンとイオウの合計含有率を０．０７％以下に規制することにより、半導体チツプとの接合時におけるリードフレームの熱的影響によるニツケルの脆化を抑制して、十分な機械的強度を得ることができ、リードフレームどうしが接触したりするようなことがない。このようなことから、信頼性の高い半導体装置を提供することができる。

【図面の簡単な説明】

【図１】本発明の実施例に係るフインガの一部を断面した斜視図である。

【図２】そのフインガの長手方向の断面図である。

【図３】そのフインガの一部を示す平面図である。

【図４】本発明におけるフインガの他の実施例を示す斜視図である。

【図５】本発明の実施例に係るリードフレームの製造工程を示す図である。

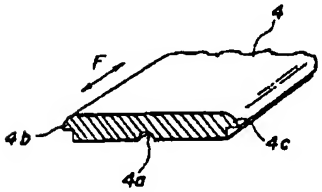
【図６】フインガ部のレジストパターンを示す図である。

【図７】リードフレームの形状を示す平面図である。

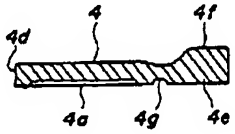
【符号の説明】

1　半導体チツプ
4　フインガ
7　リードフレーム

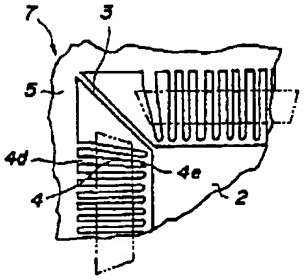
【図１】



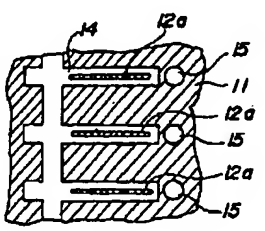
【図２】



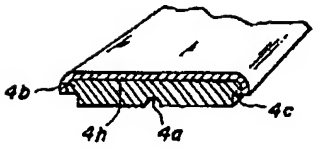
【図３】



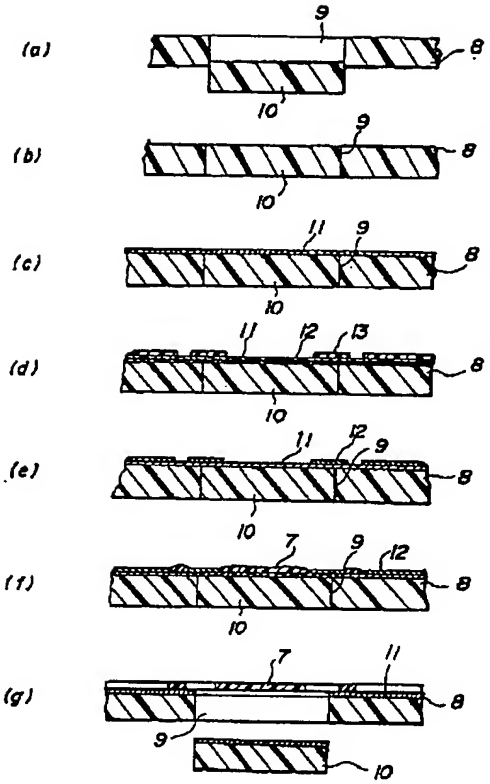
【図６】



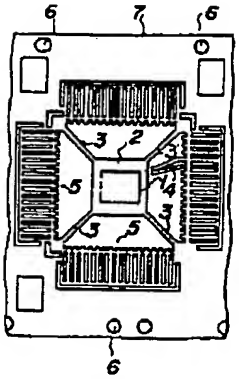
【図4】



【図5】



【図7】



フロントページの続き

(72)発明者　坂田　栄二
福岡県田川郡方城町大字伊方4680番地　九州日立マクセル株式会社内

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The semiconductor device characterized by regulating the sulfur content of the nickel material which forms said bump to 0.04% or less in the semiconductor device which comes to connect the bump of a leadframe with the electrode of a semiconductor chip.
[Claim 2] The semiconductor device characterized by for the nickel material which forms said bump being regulated by the range whose content of carbon is 0.01 - 0.04% including carbon and sulfur, and being regulated by the range whose sulphuric content is 0.01 - 0.04% in the semiconductor device which comes to connect the bump of a leadframe with the electrode of a semiconductor chip, and regulating the sum total content of carbon and sulfur to 0.07% or less.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the semiconductor device equipped with semiconductor chips, such as IC and LSI, and relates especially to the leadframe of the semiconductor device.
[0002]
[Description of the Prior Art] The metal leadframe is used for the assembly of the semiconductor device which unified the semiconductor chip by resin mold conventionally, and protruded two or more pins. The configuration of this leadframe consists of the tab lead 3 which supports the tab 2 of the rectangle which attaches a semiconductor chip 1 in those four corners, a finger 4 of a large number which make an inner edge face the periphery of a tab 2, a frame part 5 which supports these fingers 4 and the outer edge of the tab lead 3, and a sprocket hole 6 established in the both-ends edge of a frame part 5 at ****** constant interval, as shown in drawing 7 .
[0003] In order to have assembled the semiconductor device using such a leadframe 7, the semiconductor chip 1 was first attached on the tab 2, the inner edge (point) of the finger 4 corresponding to this was directly joined to each electrode of a semiconductor chip 1, the mold of the inside field of a frame part 5 was carried out with synthetic resin, the semiconductor chip 1 was covered, and the semiconductor device of a flat lead or an inline type had been obtained by subsequently excising a frame part 5.
[0004]
[Problem(s) to be Solved by the Invention] By the way, in the conventional semiconductor device, the problem was in the mechanical strength of a leadframe, and this invention persons found out that the content of a brightener had influenced, as a result of examining this point. That is, although carbon and sulfur are used as a brightener when forming a leadframe by nickel electroforming, the content of this brightener is usually about 0.1%. Thus, if the content of a brightener is high, at the time of the junction (soldering) to a semiconductor chip, by the temperature rise of a leadframe, nickel will stiffen and a mechanical strength will fall. Moreover, if a brightener is not contained at all, the beginning to a mechanical strength is weak and a possibility of contacting the next leadframe therefore and connecting too hastily is in the deformation at the time of processing.
[0005] Especially, when the content of the sulfur in a brightener is high, in addition to the above-mentioned problem, the nickel of a leadframe and the tin in solder react, the bad nickel-Sn alloy layer of adhesion is formed, and a leadframe may exfoliate from a semiconductor chip.
[0006] The fault of the conventional technique mentioned above is canceled, a leadframe has sufficient mechanical strength, and, moreover, the purpose of this invention has junction to the electrode of a semiconductor chip, and a leadframe in offering a positive reliable semiconductor device.
[0007]
[Means for Solving the Problem] In order to attain said purpose, the 1st this invention is characterized by regulating the sulfur content of the nickel material which forms said bump to 0.04% or less in the semiconductor device which comes to connect the bump of a leadframe with the electrode of a semiconductor chip.
[0008] In order to attain said purpose, the 2nd this invention is characterized by for the nickel material which forms said bump being regulated by the range whose content of carbon is 0.01 - 0.04% including carbon and sulfur, and being regulated by the range whose sulphuric content is 0.01 - 0.04%, and regulating the sum total content of carbon and sulfur to 0.07% or less in the semiconductor device which comes to connect the bump of a leadframe with the electrode of a semiconductor chip.

[0009]
[Function] By regulating the content of the sulfur in the nickel material which forms a bump to 0.04% or less like the 1st invention, generation of a nickel-Sn alloy layer can be controlled and junction to a semiconductor chip and a leadframe can be ensured.
[0010] the content of the carbon in the nickel material which forms a bump like the 2nd invention -- 0.01 - 0.04% of range -- sulphuric content -- 0.01 - 0.04% of range -- leadframes seem and to control embrittlement of the nickel under the thermal effect of the leadframe at the time of junction to a semiconductor chip, to be able to obtain sufficient mechanical strength, and not to contact by regulating the sum total content of carbon and sulfur to 0.07% or less
[0011]
[Example] Next, the example of this invention is explained with drawing. It is the sectional view in which the top view in which the perspective view and drawing 2 R> 2 which drawing 1 made a part of finger the cross section, and was shown show drawing of longitudinal section of a finger point, and drawing 3 shows a part of finger, the perspective view which drawing 4 made the cross section a part of finger which shows other examples, and was shown, drawing in which drawing 5 shows the production process of a leadframe, the top view in which drawing 6 shows the resist pattern of the finger section, and drawing 7 show the top view of a leadframe, and drawing 8 shows the connection of a finger and the electrode of a semiconductor chip.
[0012] The finger 4 consisted of a metal layer, and it had conductivity, and had ********** 4a in the central subordinate side of that at the longitudinal direction F (refer to drawing 1), and the ridgeline equips with the radii-like flanges 4b and 4c the both sides of the top face connected with the electrode of a semiconductor chip as shown in drawing 1 . As the two-dot chain line of drawing 3 shows, **** 4a is formed in the interstitial segment except 4d of bases of a finger 4, and point (toe) 4e, and is increasing the second moment of area [as opposed to bending for the cross-section configuration in this pars intermedia] with few ingredients as a **** U shape.
[0013] Moreover, as shown in drawing 2 , thick bump 4f by which point 4e of a finger 4 is connected with the electrode of a semiconductor chip 1 is formed. 4g of crevices which extended in the direction which carries out an abbreviation rectangular cross with said **** 4a is formed in the inferior surface of tongue of the part which connects this point 4e and interstitial segment, and bump 4f projected from the top face of an interstitial segment to them is formed from 4g of crevices.
[0014] Drawing 4 is the perspective view having shown other examples of a finger 4, and carries out the laminating of the 4h of the metal thin films to the top face of the finger 4 of said example further. The rigidity of a finger 4 can be made to increase further by doing in this way.
[0015] Drawing 5 shows the production process of the leadframe of this finger structure.
[0016] As first shown in the (a) and (b) Fig., the device hole 9 is formed in the film 8 with a thickness of about 35-70 micrometers it is thin from synthetic resin, such as polyimide and polyester, by press working of sheet metal by the push back procedure as base material. Push back procedure is fitting and the processing approach made to hold in the ** device hole 9 which a request part is therefore first pierced to a force plunger, and a carrier type is subsequently raised again, and digs the piece 10 of **** once as shown in the (b) Fig., as shown in the (a) Fig. Therefore, the device hole 9 is maintained in the condition of the (b) Fig. by which opening is not carried out, and a film 8 can deal with after processing as a sheet of one sheet. In addition, in addition to this at the time of formation of this device hole 9, window parts, such as a sprocket hole 6 (refer to drawing 7), can also be formed in coincidence, for example.
[0017] Next, on said film 8 by which opening is not carried out, as shown in the (c) Fig., the conductive metal layers 11, such as copper, are formed in thin film means forming, such as electroless deposition and vacuum evaporationo. Furthermore, on the conductive metal layer 11, as shown in the (d) Fig., a photoresist layer 12 is applied, or a dry film-like resist layer with a thickness of about 150 micrometers is stuck, only the part exposed by washing after exposing to a request pattern, covering a photo mask 13 is removed, and the resist layer 12 like the (e) Fig. is formed on the conductive metal layer 11.
[0018] After pushback, although this conductive metal layer 11 and photoresist layer 12 tend to drop out like the object with which it has a function as a tacking means to prevent omission of the piece 10 of ****, and pushback of the ****** was carried out like a film, they are effective in especially a temporary stop.
[0019] Next, if exfoliation processing is performed with a selenious acid, caustic alkali of sodium, etc. on this film 8 and nickel is electroformed, the leadframe 7 of a request pattern will be formed on the conductive metal

layer 11 in which the resist layer 12 is not formed as shown in the (f) Fig.
[0020] Although a brightener is added in case a leadframe 7 is electroformed with nickel, this brightener consists of carbon and sulfur and both sum total is regulated to 0.07% or less. Among those, it is regulated by the range whose content of carbon is 0.01 - 0.04%, and is regulated by the range whose sulphuric content is 0.01 - 0.04%. The concrete content of carbon and sulfur is suitably chosen from within the limits of the above-mentioned.
[0021] If the content of a brightener turns into high content exceeding 0.07% (the content [That is, the content of carbon] of 0.04% and sulfur 0.04%), as usual, by the temperature rise of the leadframe 7 at the time of junction to a semiconductor chip, nickel will stiffen and a mechanical strength will fall. On the other hand, if less than 0.01%, i.e., a brightener, is not substantially added [the content of carbon] for the content of less than 0.01% and sulfur, the mechanical strength of a leadframe 7 is not enough from the beginning, and a possibility of contacting the next leadframe 7 therefore and connecting too hastily is in the deformation at the time of processing.
[0022] By regulating the content of carbon in 0.01 - 0.04% of range, since it is such, regulating sulphuric content in 0.01 - 0.04% of range, and making sum total content of carbon and sulfur 0.07% or less, embrittlement of the nickel under the thermal effect of the leadframe 7 at the time of junction to a semiconductor chip can be controlled, and sufficient mechanical strength can be obtained.
[0023] Moreover, by regulating sulphuric content to 0.04% or less, generating of a nickel-Sn alloy layer like before can be controlled, and connection between the electrode of a semiconductor chip and a leadframe 7 can be ensured.
[0024] By removing the resist layer 12 after electrocasting formation, a leadframe 7 is formed on the base material which has conductivity over the whole surface, and the finger 4 of the leadframe 7 is held through the conductive metal layer 11 on said piece 10 of ****.
[0025] If it fails to extract the piece 10 of **** which has closed the device hole 9 in order to join to a semiconductor chip, the leadframe 7 of the cross section like the (g) Fig. will be formed on the synthetic-resin film 8. In this case, since exfoliation processing is performed to the front face in which the leadframe 7 of the conductive metal layer 11 is moreover formed, the conductive metal layer 11 is extracted, and the dropping force is small, ends and does not make it to be the about thickness of extent prepared in order to secure conductivity required for electrocasting, for example, 5-10 micrometers, and transform a leadframe 7.
[0026] Thus, after failing to extract the piece 10 of ****, a semiconductor chip 1 is carried and it connects with a finger 4.
[0027] In addition, in the above-mentioned example, although the leadframe 7 was formed on the synthetic-resin film 8 as base material, it can also use metal films, such as conductive stainless steel, as such base material.
[0028] In this case, it is possible for it not to be necessary to newly form the conductive metal layer 11 which consists of ****** shown in the (c) Fig., to form a photoresist layer 12 on a metal film, and to form the leadframe 7 which therefore becomes direct electrocasting from nickel, copper, gold, those alloys, etc. on a metal film.
[0029] Drawing 6 is drawing showing the resist pattern of the finger section in said production process.
[0030] In the finger section, besides the resist layer 12 for fingers of a desired pattern, ****** resist section 12a is formed in that longitudinal direction, and the above-mentioned **** 4a is formed in the center of the non-resist section 14 of the location corresponding to a finger 4 corresponding to this resist section 12a.
[0031] Moreover, if the circular non-resist section 15 therefore divided into the resist layer 12 is formed at the tip of the non-resist section 14 and a electrocasting operation is performed on the metal which has such a resist layer 12 Although formed separately from the metal layer which grows on the circular non-resist section 15 from which ****** was separated the first stage after electrocasting initiation, and finger 4 body was therefore separated into the resist layer 12 The metal on the non-resist section 15 separated when electrocasting advanced further, and finger 4 body are connected with one exceeding the resist layer 12. And since the thickness of the metal by which a laminating is therefore carried out to electrocasting is therefore influenced by current density, compared with a plate-like four finger soma, the metal layer on the punctiform non-resist section 15 becomes thicker, and it forms bump 4f as shown in drawing 2 .
[0032] In addition, what is necessary is just to give the second electrocasting shaping in addition to the above-mentioned electrocasting forming cycle, in forming 4h of metal thin films as shown in drawing 4 .

[0033] Moreover, in case a leadframe 7 is electroformed with metals, such as nickel, the leadframe 7 which piled up the bilayer of the layer which a brightener does not contain, and the layer which the brightener contained can also be made. If it electroforms without putting in a brightener, the temperature concentration at the time of surface roughening of the front face being carried out, it becoming what has remarkable irregularity, and joining in the state of the temperature concentration at the time of junction to a semiconductor chip, especially a pressure welding for this reason tends to take place, moreover, it will become low, and big stress is not applied to a semiconductor chip, but ** also ends, and a degree of hardness can also make junction a positive thing.

[0034] On the other hand, if the layer containing a brightener is prepared in a plane of composition and the opposite side, the mechanical strength as a leadframe 7 is securable. In addition, it is necessary to restrict the content of a brightener to 0.07% or less.

[0035]

[Effect of the Invention] By regulating the content of the sulfur in the nickel material which forms a bump to 0.04% or less like the 1st invention, generation of a nickel-Sn alloy layer can be controlled and junction to a semiconductor chip and a leadframe can be ensured.

[0036] the content of the carbon in the nickel material which forms a bump like the 2nd invention -- 0.01 - 0.04% of range -- sulphuric content -- 0.01 - 0.04% of range -- leadframes seem and to control embrittlement of the nickel under the thermal effect of the leadframe at the time of junction to a semiconductor chip, to be able to obtain sufficient mechanical strength, and not to contact by regulating the sum total content of carbon and sulfur to 0.07% or less Since it is such, a reliable semiconductor device can be offered.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to the semiconductor device equipped with semiconductor chips, such as IC and LSI, and relates especially to the leadframe of the semiconductor device.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] The metal leadframe is used for the assembly of the semiconductor device which unified the semiconductor chip by resin mold conventionally, and protruded two or more pins. The configuration of this leadframe consists of the tab lead 3 which supports the tab 2 of the rectangle which attaches a semiconductor chip 1 in those four corners, a finger 4 of a large number which make an inner edge face the periphery of a tab 2, a frame part 5 which supports these fingers 4 and the outer edge of the tab lead 3, and a sprocket hole 6 established in the both-ends edge of a frame part 5 at ****** constant interval, as shown in drawing 7 .
[0003] In order to have assembled the semiconductor device using such a leadframe 7, the semiconductor chip 1 was first attached on the tab 2, the inner edge (point) of the finger 4 corresponding to this was directly joined to each electrode of a semiconductor chip 1, the mold of the inside field of a frame part 5 was carried out with synthetic resin, the semiconductor chip 1 was covered, and the semiconductor device of a flat lead or an inline type had been obtained by subsequently excising a frame part 5.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] By regulating the content of the sulfur in the nickel material which forms a bump to 0.04% or less like the 1st invention, generation of a nickel-Sn alloy layer can be controlled and junction to a semiconductor chip and a leadframe can be ensured.
[0036] the content of the carbon in the nickel material which forms a bump like the 2nd invention -- 0.01 - 0.04% of range -- sulphuric content -- 0.01 - 0.04% of range -- leadframes seem and to control embrittlement of the nickel under the thermal effect of the leadframe at the time of junction to a semiconductor chip, to be able to obtain sufficient mechanical strength, and not to contact by regulating the sum total content of carbon and sulfur to 0.07% or less Since it is such, a reliable semiconductor device can be offered.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, in the conventional semiconductor device, the problem was in the mechanical strength of a leadframe, and this invention persons found out that the content of a brightener had influenced, as a result of examining this point. That is, although carbon and sulfur are used as a brightener when forming a leadframe by nickel electroforming, the content of this brightener is usually about 0.1%. Thus, if the content of a brightener is high, at the time of the junction (soldering) to a semiconductor chip, by the temperature rise of a leadframe, nickel will stiffen and a mechanical strength will fall. Moreover, if a brightener is not contained at all, the beginning to a mechanical strength is weak and a possibility of contacting the next leadframe therefore and connecting too hastily is in the deformation at the time of processing.
[0005] Especially, when the content of the sulfur in a brightener is high, in addition to the above-mentioned problem, the nickel of a leadframe and the tin in solder react, the bad nickel-Sn alloy layer of adhesion is formed, and a leadframe may exfoliate from a semiconductor chip.
[0006] The fault of the conventional technique mentioned above is canceled, a leadframe has sufficient mechanical strength, and, moreover, the purpose of this invention has junction to the electrode of a semiconductor chip, and a leadframe in offering a positive reliable semiconductor device.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] In order to attain said purpose, the 1st this invention is characterized by regulating the sulfur content of the nickel material which forms said bump to 0.04% or less in the semiconductor device which comes to connect the bump of a leadframe with the electrode of a semiconductor chip.
[0008] In order to attain said purpose, the 2nd this invention is characterized by for the nickel material which forms said bump being regulated by the range whose content of carbon is 0.01 - 0.04% including carbon and sulfur, and being regulated by the range whose sulphuric content is 0.01 - 0.04%, and regulating the sum total content of carbon and sulfur to 0.07% or less in the semiconductor device which comes to connect the bump of a leadframe with the electrode of a semiconductor chip.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

OPERATION

[Function] By regulating the content of the sulfur in the nickel material which forms a bump to 0.04% or less like the 1st invention, generation of a nickel-Sn alloy layer can be controlled and junction to a semiconductor chip and a leadframe can be ensured.
[0010] the content of the carbon in the nickel material which forms a bump like the 2nd invention -- 0.01 - 0.04% of range -- sulphuric content -- 0.01 - 0.04% of range -- leadframes seem and to control embrittlement of the nickel under the thermal effect of the leadframe at the time of junction to a semiconductor chip, to be able to obtain sufficient mechanical strength, and not to contact by regulating the sum total content of carbon and sulfur to 0.07% or less

---

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example] Next, the example of this invention is explained with drawing. It is the sectional view in which the top view in which the perspective view and drawing 2 R> 2 which drawing 1 made a part of finger the cross section, and was shown show drawing of longitudinal section of a finger point, and drawing 3 shows a part of finger, the perspective view which drawing 4 made the cross section a part of finger which shows other examples, and was shown, drawing in which drawing 5 shows the production process of a leadframe, the top view in which drawing 6 shows the resist pattern of the finger section, and drawing 7 show the top view of a leadframe, and drawing 8 shows the connection of a finger and the electrode of a semiconductor chip.
[0012] The finger 4 consisted of a metal layer, and it had conductivity, and had ********** 4a in the central subordinate side of that at the longitudinal direction F (refer to drawing 1), and the ridgeline equips with the radii-like flanges 4b and 4c the both sides of the top face connected with the electrode of a semiconductor chip as shown in drawing 1 . As the two-dot chain line of drawing 3 shows, **** 4a is formed in the interstitial segment except 4d of bases of a finger 4, and point (toe) 4e, and is increasing the second moment of area [as opposed to bending for the cross-section configuration in this pars intermedia] with few ingredients as a **** U shape.
[0013] Moreover, as shown in drawing 2 , thick bump 4f by which point 4e of a finger 4 is connected with the electrode of a semiconductor chip 1 is formed. 4g of crevices which extended in the direction which carries out an abbreviation rectangular cross with said **** 4a is formed in the inferior surface of tongue of the part which connects this point 4e and interstitial segment, and bump 4f projected from the top face of an interstitial segment to them is formed from 4g of crevices.
[0014] Drawing 4 is the perspective view having shown other examples of a finger 4, and carries out the laminating of the 4h of the metal thin films to the top face of the finger 4 of said example further. The rigidity of a finger 4 can be made to increase further by doing in this way.
[0015] Drawing 5 shows the production process of the leadframe of this finger structure.
[0016] As first shown in the (a) and (b) Fig., the device hole 9 is formed in the film 8 with a thickness of about 35-70 micrometers it is thin from synthetic resin, such as polyimide and polyester, by press working of sheet metal by the push back procedure as base material. Push back procedure is fitting and the processing approach made to hold in the ** device hole 9 which a request part is therefore first pierced to a force plunger, and a carrier type is subsequently raised again, and digs the piece 10 of **** once as shown in the (b) Fig., as shown in the (a) Fig. Therefore, the device hole 9 is maintained in the condition of the (b) Fig. by which opening is not carried out, and a film 8 can deal with after processing as a sheet of one sheet. In addition, in addition to this at the time of formation of this device hole 9, window parts, such as a sprocket hole 6 (refer to drawing 7), can also be formed in coincidence, for example.
[0017] Next, on said film 8 by which opening is not carried out, as shown in the (c) Fig., the conductive metal layers 11, such as copper, are formed in thin film means forming, such as electroless deposition and vacuum evaporationo. Furthermore, on the conductive metal layer 11, as shown in the (d) Fig., a photoresist layer 12 is applied, or a dry film-like resist layer with a thickness of about 150 micrometers is stuck, only the part exposed by washing after exposing to a request pattern, covering a photo mask 13 is removed, and the resist layer 12 like the (e) Fig. is formed on the conductive metal layer 11.
[0018] After pushback, although this conductive metal layer 11 and photoresist layer 12 tend to drop out like the object with which it has a function as a tacking means to prevent omission of the piece 10 of ****, and pushback of the ****** was carried out like a film, they are effective in especially a temporary stop.
[0019] Next, if exfoliation processing is performed with a selenious acid, caustic alkali of sodium, etc. on this

film 8 and nickel is electroformed, the leadframe 7 of a request pattern will be formed on the conductive metal layer 11 in which the resist layer 12 is not formed as shown in the (f) Fig.
[0020] Although a brightener is added in case a leadframe 7 is electroformed with nickel, this brightener consists of carbon and sulfur and both sum total is regulated to 0.07% or less. Among those, it is regulated by the range whose content of carbon is 0.01 - 0.04%, and is regulated by the range whose sulphuric content is 0.01 - 0.04%. The concrete content of carbon and sulfur is suitably chosen from within the limits of the above-mentioned.
[0021] If the content of a brightener turns into high content exceeding 0.07% (the content [That is, the content of carbon] of 0.04% and sulfur 0.04%), as usual, by the temperature rise of the leadframe 7 at the time of junction to a semiconductor chip, nickel will stiffen and a mechanical strength will fall. On the other hand, if less than 0.01%, i.e., a brightener, is not substantially added [the content of carbon] for the content of less than 0.01% and sulfur, the mechanical strength of a leadframe 7 is not enough from the beginning, and a possibility of contacting the next leadframe 7 therefore and connecting too hastily is in the deformation at the time of processing.
[0022] By regulating the content of carbon in 0.01 - 0.04% of range, since it is such, regulating sulphuric content in 0.01 - 0.04% of range, and making sum total content of carbon and sulfur 0.07% or less, embrittlement of the nickel under the thermal effect of the leadframe 7 at the time of junction to a semiconductor chip can be controlled, and sufficient mechanical strength can be obtained.
[0023] Moreover, by regulating sulphuric content to 0.04% or less, generating of a nickel-Sn alloy layer like before can be controlled, and connection between the electrode of a semiconductor chip and a leadframe 7 can be ensured.
[0024] By removing the resist layer 12 after electrocasting formation, a leadframe 7 is formed on the base material which has conductivity over the whole surface, and the finger 4 of the leadframe 7 is held through the conductive metal layer 11 on said piece 10 of ****.
[0025] If it fails to extract the piece 10 of **** which has closed the device hole 9 in order to join to a semiconductor chip, the leadframe 7 of the cross section like the (g) Fig. will be formed on the synthetic-resin film 8. In this case, since exfoliation processing is performed to the front face in which the leadframe 7 of the conductive metal layer 11 is moreover formed, the conductive metal layer 11 is extracted, and the dropping force is small, ends and does not make it to be the about thickness of extent prepared in order to secure conductivity required for electrocasting, for example, 5-10 micrometers, and transform a leadframe 7.
[0026] Thus, after failing to extract the piece 10 of ****, a semiconductor chip 1 is carried and it connects with a finger 4.
[0027] In addition, in the above-mentioned example, although the leadframe 7 was formed on the synthetic-resin film 8 as base material, it can also use metal films, such as conductive stainless steel, as such base material.
[0028] In this case, it is possible for it not to be necessary to newly form the conductive metal layer 11 which consists of ****** shown in the (c) Fig., to form a photoresist layer 12 on a metal film, and to form the leadframe 7 which therefore becomes direct electrocasting from nickel, copper, gold, those alloys, etc. on a metal film.
[0029] Drawing 6 is drawing showing the resist pattern of the finger section in said production process.
[0030] In the finger section, besides the resist layer 12 for fingers of a desired pattern, ****** resist section 12a is formed in that longitudinal direction, and the above-mentioned **** 4a is formed in the center of the non-resist section 14 of the location corresponding to a finger 4 corresponding to this resist section 12a.
[0031] Moreover, if the circular non-resist section 15 therefore divided into the resist layer 12 is formed at the tip of the non-resist section 14 and a electrocasting operation is performed on the metal which has such a resist layer 12 Although formed separately from the metal layer which grows on the circular non-resist section 15 from which ****** was separated the first stage after electrocasting initiation, and finger 4 body was therefore separated into the resist layer 12 The metal on the non-resist section 15 separated when electrocasting advanced further, and finger 4 body are connected with one exceeding the resist layer 12. And since the thickness of the metal by which a laminating is therefore carried out to electrocasting is therefore influenced by current density, compared with a plate-like four finger soma, the metal layer on the punctiform non-resist section 15 becomes thicker, and it forms bump 4f as shown in drawing 2 .
[0032] In addition, what is necessary is just to give the second electrocasting shaping in addition to the above-

mentioned electrocasting forming cycle, in forming 4h of metal thin films as shown in drawing 4 .
[0033] Moreover, in case a leadframe 7 is electroformed with metals, such as nickel, the leadframe 7 which piled up the bilayer of the layer which a brightener does not contain, and the layer which the brightener contained can also be made. If it electroforms without putting in a brightener, the temperature concentration at the time of surface roughening of the front face being carried out, it becoming what has remarkable irregularity, and joining in the state of the temperature concentration at the time of junction to a semiconductor chip, especially a pressure welding for this reason tends to take place, moreover, it will become low, and big stress is not applied to a semiconductor chip, but ** also ends, and a degree of hardness can also make junction a positive thing.
[0034] On the other hand, if the layer containing a brightener is prepared in a plane of composition and the opposite side, the mechanical strength as a leadframe 7 is securable. In addition, it is necessary to restrict the content of a brightener to 0.07% or less.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view which carried out the cross section of a part of finger concerning the example of this invention.
[Drawing 2] It is the sectional view of the longitudinal direction of the finger.
[Drawing 3] It is the top view showing a part of the finger.
[Drawing 4] It is the perspective view showing other examples of the finger in this invention.
[Drawing 5] It is drawing showing the production process of the leadframe concerning the example of this invention.
[Drawing 6] It is drawing showing the resist pattern of the finger section.
[Drawing 7] It is the top view showing the configuration of a leadframe.
[Description of Notations]
1 Semiconductor Chip
4 Finger
7 Leadframe

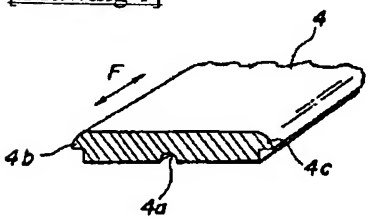
[Translation done.]

* NOTICES *

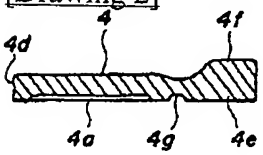
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

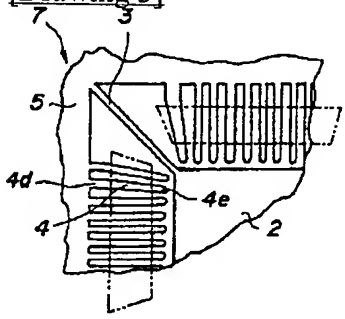
[Drawing 1]



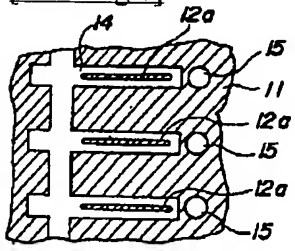
[Drawing 2]



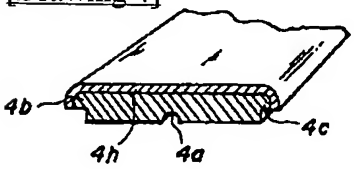
[Drawing 3]



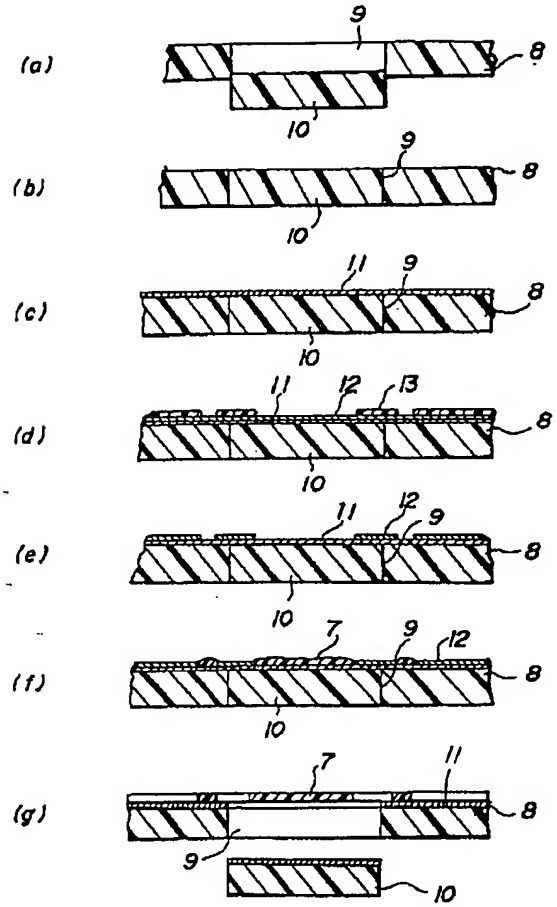
[Drawing 6]



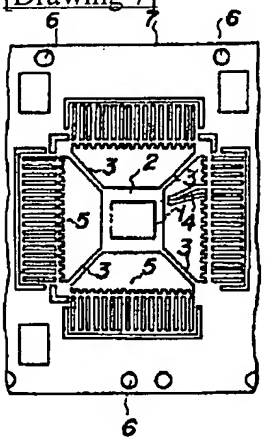
[Drawing 4]



[Drawing 5]



[Drawing 7]



[Translation done.]